

Claims

I claim:

## 1. A metal detector, comprising:

- (a) a radio frequency oscillator;
- (b) an oscillator coil, the coil being electrically interconnected to the oscillator so as to emit a magnetic field in a region surrounding the oscillator coil;
- (c) a first input coil residing within the magnetic field, the first input coil generating a first signal in response to a disturbance of the magnetic field;
- (d) a second input coil residing within the magnetic field, the second input coil generating a second signal in response to a disturbance of the magnetic field; and
- (e) a signal processor, the signal processor measuring a ratio of the first signal and the second signal so as to determine a physical location of an item causing the disturbance of the magnetic field.
- 2. The metal detector according to claim 1, wherein the signal processor records a first peak attributable to the first signal and the signal processor records a second peak attributable to the second signal, the signal processor determining a direction of travel of the item causing the disturbance of the magnetic field.

- 3. The apparatus according to claim 1, wherein the metal detector further comprises:
- (a) a case, the case housing the oscillator, the oscillator coil, the first and second input coils, and the signal processor;
- (b) a cavity, the cavity residing within the case, the cavity being dimensioned to house a product while being examined for metal contaminants;
- (c) a first aperture formed within the case and permitting the product to enter the cavity;
- (d) a second cavity, the second cavity being formed within the case and permitting the product to exit the cavity; and
- (e) a conveyor, the conveyor transporting the product through the cavity
- 4. An apparatus according to claim 1, wherein the signal processor associates a disturbance of the magnetic field with a metallic item when the item is determined to reside within the cavity.
- 5. An apparatus according to claim 1, wherein the signal processor excludes as a potential metallic contaminant an item causing a disturbance of the magnetic field when the disturbance is attributable to a metallic item residing outside of the cavity.

- 6. An apparatus according to claim 1, wherein the signal processor separates the first signal into a resistive component and a reactive component, and the signal processor separates the second signal into a resistive component and a reactive component.
- 7. The apparatus of claim 6, further comprising a flux concentrator, the flux concentrator being mounted within the case so as to be adjacent to the cavity, the flux concentrator increasing inductance of the oscillator coil.
- 8. The apparatus of claim 8, wherein the oscillator coil is formed as first and second adjacent oscillator coils, the first and second oscillator coils being interconnected in a parallel relationship.
- 9. The apparatus of claim 8, wherein the oscillator coil is formed as first and second adjacent oscillator coils, the first and second oscillator coils being interconnected in a series relationship.

- 10. A metal detector having a reduced metal free zone, comprising:
  - (a) an oscillator;
- (b) an oscillator coil, the coil being electrically interconnected to the oscillator so as to emit a magnetic field in a region surrounding the oscillator coil;
- (c) a first input coil residing within the magnetic field, the first input coil generating a first signal in response to a disturbance of the magnetic field;
- (d) a second input coil residing within the magnetic field, the second input coil generating a second signal in response to a disturbance of the magnetic field; and
- (e) an input coil voltage monitor, the voltage monitor being electrically interconnected to the first and second input coils, the voltage monitoring calculating an instantaneous ratio between a voltage amplitude of the first signal and a voltage amplitude of the second signal so as to determine a physical location of an item causing a disturbance of the magnetic field.

- 11. A method of detecting metal, comprising the steps of:
  - (a) radiating an magnetic field;
- (b) simultaneously monitoring a voltage induced by a disturbance of the magnetic field from a first position and a second position; and
- (c) calculating a ratio of voltage measured at the first position and the second position; and
- (d) determining a location of an item causing the disturbance of the magnetic field based on the ratio of current at each location.
- 12. The method of claim 11, further comprising the steps of:
  - (a) placing a product under test within a cavity;
- (b) determining if the item causing the disturbance to the magnetic field is located within the cavity; and
- (c) categorizing the item as a metallic contaminant when the item is located within the cavity.